BRIEF

STARS
Color and Temperature

Overview

This class focuses on a basic understanding of Stellar Temperatures, Colors, and Magnitudes.

Why does this matter?

The fundamental reason that we study Double Stars is to better understand, and revise, stellar theories that rely on a mass determination.

Determining the orbits of Binary Stars, helps us understand stellar masses and from there, the connections to better refining theories on temperatures, colors, and magnitudes.

What do you see?

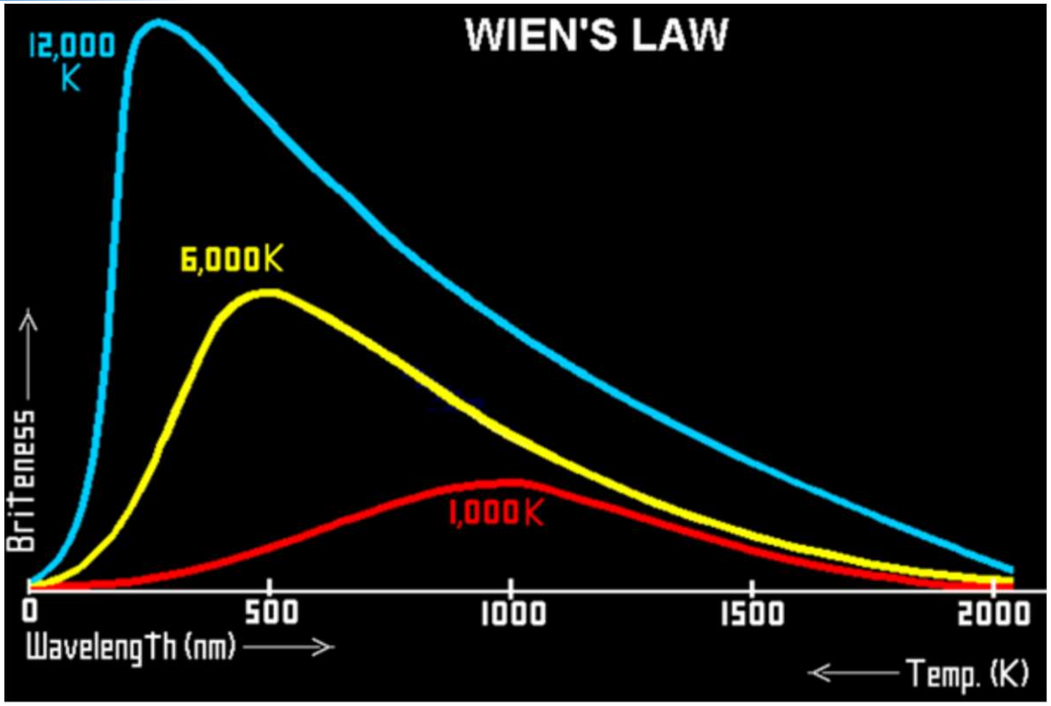
Look at the two images below. What do you see?

- Are they all the same?
- Are they the same size?
- Are they the same brightness?
- How do the colors differ?
- What do the colors mean?

Color and Temperature

Star color is based on the temperature of its Photosphere: Surface.

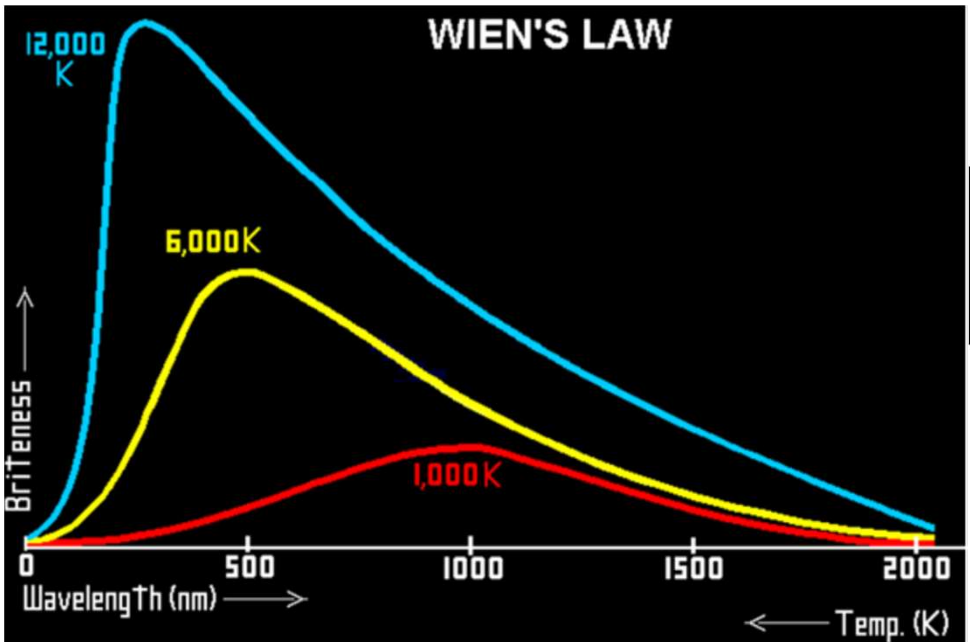
Wien's law, right, states that the hotter an object is, higher its luminosity (peak wavelength) and shorter the wavelength. The cooler the object, the less the luminosity and longer the wavelength.



$$\lambda_m = \frac{2.898x105}{T}$$

Application

Using the image of Orion, review the stellar color, and thus temperature relative to Wien's graph and the stellar class.



Stellar Classes

Stellar colors, and thus temperatures, are categorized from hottest to coolest: O, B, A, F, G, K, M also known through the mnemonic: "Oh Be A Fine Girl/Guy Kiss Me".

Below is a chart showing the rough temperatures (in Kelvin) relative to the colors. ALSO, you will note a rough Mass, Radius, and other estimations.

Class	Effective temperature[1][2][3]	Conventional color description	Actual apparent color[4][5][6]	Mass[1][7] (solar masses)	Radius[1][7] (solar radii)	Luminosity[1][7] (bolometric)
O	≥ 30,000 K	blue	blue	≥ 16 M☉	≥ 6.6 R☉	≥ 30,000 L☉
B	10,000–30,000 K	blue white	deep blue white	2.1–16 M☉	1.8–6.6 R☉	25–30,000 L☉
A	7,500–10,000 K	white	blue white	1.4–2.1 M☉	1.4–1.8 R☉	5–25 L☉
F	6,000–7,500 K	yellow white	white	1.04–1.4 M☉	1.15–1.4 R☉	1.5–5 L☉
G	5,200–6,000 K	yellow	yellowish white	0.8–1.04 M☉	0.96–1.15 R☉	0.6–1.5 L☉
K	3,700–5,200 K	orange	pale yellow orange	0.45–0.8 M☉	0.7–0.96 R☉	0.08–0.6 L☉
M	2,400–3,700 K	red	light orange red	0.08–0.45 M☉	≤ 0.7 R☉	≤ 0.08 L☉
L	1,300–2,400 K	red brown[citation needed]	scarlet[citation needed]	0.005–0.08 M☉	0.08–0.15 R☉	0.000,05–0.001 L☉
T	500–1,300 K	brown[citation needed]	magenta[9][10]	0.001–0.07 M☉	0.08–0.14 R☉	0.000,001–0.000,05 L☉
Y	≤ 500 K	dark brown[citation needed]	black[citation needed]	0.0005–0.02 M☉	0.08–0.14 R☉	0.000,000,1–0.000,001 L☉

Summary

Color and Stellar Temperature are intimately linked.

The hotter an object, the bluer it is. Conversely, the cooler an object, the redder.

Therefore, understanding color, can provide clues to temperature.

Further, understanding stellar color/temperature can also provide guidance for selection of filters for CCD images when trying to separate closely spaced double stars.

Questions?